REMARKS

By this amendment, claims 1-8 and 13-20 have been revised to place this application in condition for allowance. Currently, claims 1- and 13-20 are before the Examiner for consideration on their merits.

In review, all pending claims have been revised to increase the lower limit of C from 0.01 to 0.02%, change the upper limit of Mn from 1.5 to 0.95%, and describe the stainless steel as having a plastically-processed history. Support for the change to the carbon content can be found in Table 1, Steel Nos. D and H. For Mn, Steel No. M in Table 1 provides support for the new upper limit of Mn.

Support for the description of the steel as having a plastically-processed history is found on page 14, line 26 to page 15, line 7. Table 2 also exemplifies a plastically worked stainless steel.

Applicants respectfully traverse the rejections of the claims, and the traversal is set out below under the prior art used in the rejection.

LENA

In the rejection, the Examiner asserts that Lena is still a valid reference against claims 1 and 2 for the reason that the claims do not recite a structure, that the hardness is inherent since the composition overlaps, and that Applicants have not shown that the claimed hardness could not be found in the alloy of Lena.

The rejection of claims 1 and 2 is traversed on the basis that the Lena does not teach a composition that can be considered to be overlapping of that which is claimed. The Examiner's attention is directed to Lena in terms of the stability factor Δ, which is described in Lena as follows:

When $\{\%Cr + 1.5(\%Mo)\} < 20$, then

$\Delta = Ni - (1/12)\{\%Cr + 1.5(\%Mo) - 20\}^2 + (1/2))\%Mn) + 35(\%C + \%N) - 14.$

When $\{\%Cr + 1.5(\%Mo)\} > 20$, then

$\Delta = Ni + (1/12)\{\%Cr + 1.5(\%Mo) - 20\}^2 + (1/2))\%Mn) + 35(\%C + \%N) - 14.$

And the factor specified to meet the range;

1) given the $\%C + \%N \leq 0.2$ and $\%Cr = 16\text{-}18$, Δ is $-4.65 \leq \Delta \leq -3.82$, and

2) given the %C + %N $\geq$ 0.2 and %Cr = 14.5-16, Δ is -1. $\leq \Delta \leq$ -0.01.

(It should be noted that the formula in claim 1 has an error in it and the first recitation of the formula should have a "-" instead of the "+" sign following "Ni")

Lena teaches in col. 5, lines 10-13, that "Only those steels within the range given and having a delta factor in the range given depending upon the composition as determined by the equations given are satisfactory for the purpose of this invention."

The equations of Lena must be compared with the composition of the invention according to claims 1 and 2, wherein the Cr content is limited to 15%. With this limit, the equations of Lena that are applicable for an obviousness determination are those wherein %C + %N $\geq$ 0.2, and Δ is -1. $\leq \Delta \leq$ -0.01.

Using the equation that %C + %N $\geq$ 0.2 and comparing the composition of Lena and the claimed composition, only when N is 0.1% and C is 0.1% is the equation satisfied. This is because 0.1% is the maximum amount of nitrogen and carbon that is specified in the claims.

If the Examiner were to stop here, the Examiner could possibly allege that an overlap of composition exists. However, the limits on C and N are not the end of the inquiry. Lena also requires a particular value of the stability factor Δ. When looking at this factor, it is plain to see that Lena and the claimed composition are not even remotely close.

For the Examiner's benefit, a reference Table is submitted herewith that sets forth the alloy compositions of Lena and those of the invention. The stability factor Δ is calculated for each composition and listed in the Table in the column second from the right. Then, a determination is made as to whether the stability factor of the alloys of the invention come within the range of Lena. It is clear that none of the alloys according to the instant invention meet the requirements of the Lena stability factor.

This comparison shows that the invention is not an obvious variant of Lena. In the rejection, the Examiner is basically saying that the inventive composition could be derived from the teachings of Lena. However, when considering reference Table 1, none of the compositions of the invention meet the requirements of Lena in terms of the stability factor. If one of skill in the art were practicing the teachings of Lena, the invention could be not be reached. The attached reference Table affirmatively demonstrates that Lena and the invention are not even similar in composition and Lena cannot be said to establish a *prima facie* case of obviousness against claims 1 and 2 when taking into the full realm of Lena's teachings.

It is also reiterated that the invention cannot be ascertained from Lena since Lena is not in the least bit concerned with the aim of the invention. As was already explained in the remarks submitted with the response of December 14, 2006, the technological concept of the invention is nowhere to be found in Lena. As explained in paragraphs [0018-0022] of Applicants' published application, when the martensitic stainless steel is insured to have reduced amounts of carbides, the steel can have excellent corrosion resistance, even if the steel is processed as a hot finished condition or the as quenched condition, both of which not subjected to subsequent tempering treatment.

The results can be attributed to three things. First, the mixture of Cu sulfide and Mo sulfide, which generates by adding Cu and Mo in combination, forms a tight film onto the film of Cr oxides and protects the film of Cr oxides, thus enabling to secure the resistance to sulfide stress corrosion cracking.

Second, since any type of $M_{23}C_6$ type carbide as hardly observed in as hot-finished or as quenched condition, the resistance to sulfide stress corrosion cracking can be enhanced by suppressing the precipitation of $M_{23}C_6$ type carbides which can be achieved by eliminating the tempering treatment.

Lastly, the hardness is controlled within the proper range so that corrosion wear can be enhanced.

The preferable heat treatments for accomplishing the aim of the invention can be found in paragraphs [0074-0076] of Applicants' published publication and are summarized as follows:

1) after hot rolling and subsequent heating to the temperature of Ac_3 point or more, the quenching treatment or air cooling is carried out;

2) the steel is cooled to room temperature, and then heated to the temperature of Ac_3 point or more, followed by a quenching treatment or air cooling as the final heat treatment; or

3) after the cooling step, tempering can be performed just that it is a low temperature tempering step, i.e., 400 °C or lower.

In this regard, Table 2 of the application is instructive, wherein a tempering step of 250 °C for a thirty minute duration is used satisfactorily, whereas a temperature of 600 °C for 30 minutes does not attain the aim of the invention.

Lena lacks any recognition of the problems faced by the inventors or the solution thereto. The invention is not merely tweaking the various alloy elemental ranges of Lena. Instead, the

invention provides a significant advancement in martensitic stainless steel through the use of Cu and Mo to protect Cr oxide films and enhance sulfide stress corrosion cracking.

Applicants also wish to reiterate the previous arguments that the assumption that the claimed hardness and carbide content is inherent in Lena. It is submitted that the Examiner cannot draw these conclusions of inherency for the reasons previously given and in light of the difference in composition when considering the stability factor of Lena.

To summarize, Lena does not establish a *prima facie* case of obviousness against claims 1 and 2 and the rejection must be withdrawn in light of the arguments above.

<u>YOSHIHIRO AND ASM HANDBOOK</u>

In the new rejection, Claims 3-8 are considered obvious over the combined teachings of Yoshihiro and the ASM Handbook (ASM). It is the Examiner's position that Yoshihiro teaches a composition that overlaps that which is claimed, thereby establishing obviousness, and that the claimed equations are satisfied.

For the hardness limitation, it is the Examiner's position that controlling the hardness of Yoshihiro is obvious since C and N are result effective variables when considering hardness, and one of skill in the art would find it obvious to optimize these alloying elements for hardness.

Lastly and regarding the carbide limitation, the Examiner admits that Yoshihiro says nothing about the carbide amount and relies on ASM to contend that high carbide formation occurs from high temperature treatment. Since Yoshihiro teaches a similar composition as claimed and a similar processing, the carbide limitation would be present.

Applicants respectfully traverse the rejection on the grounds that Yoshihiro and ASM do not establish a *prima facie* case of obviousness against the rejected claims.

Yoshihiro teaches a martensitic stainless steel plate that has excellent weldability and workability, and also exhibits good corrosion resistance. The plate is suitable for civil engineering and building construction and has optional elements of Cu in the range of 0.1-0.6% and Mo in the range of 0.1-0.6%.

Taking into consideration the language and amendments to the claims, Applicants submit three arguments to demonstrate the Yoshihiro and ASM do not teach or suggest the steel of claims 3-8.

First, the claims now define a C lower limit of 0.02%. In contrast, Yoshihiro defines an upper limit or maximum of C as 0.012%. One aim of Yoshihiro is to reduce C as much as possible due to the problems in welding, see paragraph [0012]. Since this is a critical aspect of Yoshihiro, one of skill in the art would not be taught to use a carbon content of 0.02% for Yoshihiro. In fact, Yoshihiro emphatically teaches away from such a modification, and cannot be said to render claims 3-8 obvious for this reason alone.

Second, the claims define a hardness of 30-45 HRC. Yoshihiro teaches a maximum hardness of Hv 292, see Plate No. 3 of Table 4. As instructive, other plates that have acceptable properties, e.g., Plate Nos. 7 and 8, have much lower hardness, with others yet, e.g., Steel Plate Nos. 12, 15, 18, 19, etc. all falling below the maximum of 292, which equates to 29 HRC. The question now is whether Yoshihiro establishes a *prima facie* case of obviousness against the hardness limitations of claims 3-8. It is submitted that there is no reason to specify a hardness range of 30-45 HRC for Yoshihiro absent the use of hindsight. Yoshihiro indicates that plates with less hardness than 29 HRC are perfectly acceptable, so why require a hardness range so much higher. There is no legitimate reason to modify Yoshihiro in this fashion and the rejection is improper in this regard.

Third, the processing of Yoshihiro is not the same as that used to create the claimed stainless steel with hardness and carbide amount. Yoshihiro teaches that an annealing in the range of 650-700 °C for 3-15 hours should take place after the hot rolling step. After this annealing, a slow cooling of 50 °C/hour in the temperature range of 600-700 °C, see paragraph [0027] should be practiced. This is in complete contrast to the heat treating conditions described above, wherein the stainless steel is either quenched or air cooled after rolling. With this different processing, it cannot be said that the carbide amounts and hardness values are inherently attained in Yoshihiro and the rejection must be withdrawn for this reason.

Another argument is that the present invention is concerned with a martensitic stainless steel that has high mechanical strength and excellent resistance to sulfide stress cracking, corrosive wear, and localized corrosion. Yoshihiro's steel is just insured to have resistance to corrosion associated with use in water-front structural products and does not require the same type of mechanical strength. Comparing the yield strengths of Table 4 of Yoshihiro with those of the inventive steels in Tables 2 and 3 on pages 18 and 19 of the specification reveals that the

two levels of strength are not even remotely close. This is a further substantiation that the steel of Yoshihiro is not even close to being similar to that which is claimed.

Lastly, and as argued above for Lena, Yoshihiro is not concerned with the problems faced by the inventors and has not developed a solution to the problems as is found in the steel of claims 3-8.

ASM does not supply the deficiencies noted above for Yoshihiro. The Examiner cites ASM for the proposition that high carbide formation results from high temperature tempering, and because of this, concludes that the claimed carbide are present in Yoshihiro since Yoshihiro does not teach a high temperature tempering. The teachings of ASM are general at best, and say nothing about the specific processing and composition of Yoshihiro. The Examiner cannot ignore the fact that the claim is more than claiming a reduced carbide formation. Rather, Applicants have gone through a painstaking study to solve the problems in oil country tubular goods and have developed a specific alloy composition with a specific hardness and level of carbides. The Examiner does not have a basis to conclude that just because ASM makes a sweeping statement that carbides are formed with higher tempering temperatures that the processing of Yoshihiro, which is specific to a particular alloy composition produces the claimed carbide content.

<u>YOSHIHIRO, ASM HANDBOOK AND KUSHIDA ET AL.</u>

Claims 13-20 stand rejected based on the combination of JP 2001-152295 to Yoshihiro, ASM, and Kushida et al. (Kushida). In this rejection, the Examiner admits that Yoshihiro does not specify an amount of Cu and Mo that would be effective to form a sulfide layer on a formed Cr oxide layer. To make up for this lacking, the Examiner cites Kushida to allege that it would be obvious to add Cu and Mo to the alloy of Yoshihiro to form the missing sulfide layer on the Cr oxide layer. The reasoning for this contention is that Kushida teaches that adding at least 0.5 mass percent of Mo and Cu to the base metal should provide sour gas resistance when being exposed to hydrogen sulfide containing fluid.

First, the rejection of claims 13-20 fails for the same reasons that the rejection of claims 3-8 fail. That is, Yoshihiro and ASM do not establish a *prima facie* case of obviousness against the claims when considering the carbide limitations, the composition, and the hardness levels.

Even if it were admitted that it would be proper to modify Yoshihiro with Kushida, the invention of claims 13-20 is still not taught.

Secondly, the Examiner has not supplied a proper reason to use Kushida to modify Yoshihiro. As explained above, Yoshihiro is concerned with a steel that is intended for building components, and is concerned with rusting of the steel, see paragraph [0002]. The teachings of Kushida that are relied upon to modify Yoshihiro relates to a weld metal composition in a sour gas environment. A weld metal and its environment has nothing to do the building component realm of Yoshihiro, and the mere existence of Kushida does not supply the required reasoning to modify Yoshihiro. As the Examiner knows, a specific reason must be present to allege obviousness, and this reasoning is lacking in this rejection. Therefore, claims 13-20 are separately patentable over the combination of Yoshihiro, ASM, and Kushida on the grounds that the Examiner does not have a reason to modify Mo and Cu in Yoshihiro as alleged.

SCHUMACHER, ASM HANDBOOK AND KUSHIDA ET AL.

Here, claims 3-8 and 13-20 are alleged to be obvious over the combined teachings of United States Patent No. 5,089,067 to Schumacher when combined with ASM and Kushida.

Applicants traverse the rejection in light of the amendments to the claims with respect to the level of Mn and the definition of the claimed steel as containing a plastically processed history.

In review Schumacher teaches a substantially martensitic stainless steel that is a **cast** steel. This steel has the properties of good castability, ductility, and the capability of being hardened to a wide range of hardnesses, see the Abstract for example.

Schumacher may have a composition that technically overlaps that which is claimed, and is one that discloses various hardnesses such as from HRB 95 to HRC 40 or higher. Notably, Schumacher does not specify that the martensitic steel has the claimed carbide content.

The heat treatment of Schumacher is explained in col. 1, lines 14-28, i.e., heat treatment in the range of 930-1095 °C followed by air or oil quench.

While the Examiner relies on ASM and Kushida to remedy deficiencies in Schumacher regarding the carbide content and the sulfide film covering the Cr oxide film, Schumacher itself is fundamentally not relevant prior art against the invention. More particularly, Schumacher is concerned with casting technology not the making of a martensitic stainless steel that is

plastically worked as is the claimed steel. This distinction is brought to life in the claims by defining the steel as having a plastically worked history.

The examples of Schumacher all pertain to a cast structure to attain the intended goal. Although the teachings of Schumacher do not rule out a step of plastic working after the casting and heat treatment, even if such working were contemplated, there is no guidance as to what working conditions were employed and without this, the Examiner cannot contend that the claimed properties would be present in the cast and worked steel of Schumacher. To draw such a conclusion would be pure speculation on the part of the Examiner and such a stance could not be sustained on appeal.

As a cast structure, Schumacher cannot be said to teach a martensitic stainless steel having a plastically worked history, and this limitation alone removes Schumacher as valid prior art against claims 3-8 and 13-20.

Referring again to the points of the invention discussed above concerning the use of Cu and Mo to protect the Cr oxide film and the various improvements in other properties for the claimed steel, Schumacher is totally unrelated to the realm of the invention and cannot be modified to replicate the invention.

It is also contended that the rejection is improper when addressing the carbide limitation. While the Examiner cites ASM for the same proposition as explained above, the Examiner's real contention is that the cast, heat treated, and air cooled structure of Schumacher is the same as the non-tempered steel of the invention, and therefore the claimed carbide content would be inherent. The problem with this approach is that it neglects to consider that the processing before the heat treatment of Schumacher is a casting process, not a working. Therefore, the process of Schumacher is not in the least similar to the invention, regardless of the heat treatment preceding cooling, and it is improper for the Examiner to allege that the carbide content is present due to comparable processing. By pointing out the fact that Schumacher teaches an entirely different process than that used in the instant invention to obtain the claimed martensitic stainless steel, Applicants have refuted the inherency contention. The Examiner now must either withdraw the rejection, or provide some other rejection basis to deal with the carbide limitation found in the claims.

ASM adds nothing to this, since the issue is casting versus working, and these two processes are not the same and the presence of casting in Schumacher precludes a conclusion that the carbide limitation is present.

Moreover, the combination of Kushida and its teachings regarding a weld metal and a sour gas environment and the cast composition of Schumacher is improper. The Examiner is using hindsight to drawn the conclusion that one of skill in the art could modify the composition of Schumacher to meet the claim limitations regarding the sulfide layer. Put another way, there is no legitimate reason that the artisan would look to the weld metal composition of Kushida and use this teaching to modify the composition of the cast structure of Schumacher. The two technologies are totally different and not compatible for the reasons proffered in the rejection.

UNEXPECTED RESULTS

Applicants also wish to reiterate the previously made arguments that the comparative evidence in the specification effectively rebuts any obvious contentions should be Examiner insist that the applied prior art still makes a *prima facie* case of obviousness.

SUMMARY

By this amendment, it is respectfully submitted that claims 1 and 2 are patentable over Lena on the grounds that a *prima facie* case of obviousness has not been established given the stability factor requirement of this reference.

Yoshihiro, the ASM Handbook, and Kushida also do not render claims 3-8 and 13-20 obvious since Yoshihiro does not teach an overlapping composition due to amendment, the hardness is not taught, nor is the processing the same to support an inherency position.

Schumacher is distinguishable on the grounds that this prior art reference pertains to cast technology, which has nothing to do with the claimed martensitic stainless steel having a plastically worked history.

Finally, the comparative evidence shows that invention still resides in the steel of claims 1-8 and 13-20.

In light of this response, the Examiner is respectfully requested to examine this application in light of this amendment, and pass claims 1-8 and 13-20 onto issuance.

If the Examiner believes that an interview with Applicants' attorney would be helpful in expediting prosecution of this application, the Examiner is respectfully requested to telephone the undersigned at 202-835-1753.

Again, reconsideration and allowance of this application is respectfully requested.

The above constitutes a complete response to all issues raised in the Office Action dated March 14, 2007.

Please charge any fee deficiency or credit any overpayment to Deposit Account No. 50-1088.

Respectfully submitted,
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【Reference Table 1】

		C	Cr	Ni	Mo	Si	Mn	N	C+N	Cr+1.5Mo	Δ1	Δ2	Δ	Conformance of Δ
D1	DE93	0.078	16.69	4.26	2.85	0.34	0.64	0.69	0.768	20.965	17.3824	17.5376		No
D1	DK49	0.074	16.64	4.64	2.8	0.24	0.82	0.06	0.134	20.84	−4.3188	−4.2012	−4.2012	Yes
D1	74508	0.077	16.9	4.4	2.53	0.25	0.67	0.07	0.147	20.695	−4.16025	−4.07975	−4.07975	Yes
D1	82661	0.128	15.78	4.19	2.8	0.44	0.96	0.13	0.258	19.98	−0.30003	−0.29997	−0.30003	Yes
D1	92370	0.14	15.44	4.85	2.74	0.37	0.95	0.1	0.24	19.55	−0.29188	−0.25813	−0.29188	Yes
D1	92603	0.136	15.36	4.41	2.56	0.2	0.89	0.12	0.256	19.2	−0.23833	−0.13167	−0.23833	Yes
D1	92546	0.133	15.58	4.34	2.7	0.28	1.02	0.12	0.253	19.63	−0.30641	−0.28359	−0.30641	Yes
D1	82401	0.14	15.26	4.25	2.71	0.38	1.03	0.11	0.25	19.325	−0.52297	−0.44703	−0.52297	Yes
Inventive ST	A	0.03	11.2	1.68	0.45		0.76	0.01	0.04	11.875	−16.0413	−5.0387	−16.0413	No
Inventive ST	B	0.05	11.5	2.5	0.3		1.25	0.02	0.07	11.95	−13.8252	−3.02479	−13.8252	No
Inventive ST	C	0.04	10.9	2.3	0.6		0.5	0.04	0.08	11.8	−14.2533	−3.04667	−14.2533	No
Inventive ST	D	0.02	10.2	4.3	0.5		1.45	0.05	0.07	10.95	−13.3502	0.300208	−13.3502	No
Inventive ST	E	0.09	14.5	1.5	0.1		1.47	0.01	0.1	14.65	−10.6502	−5.87979	−10.6502	No
Inventive ST	F	0.04	11	1.58	0.53		0.8	0.02	0.06	11.795	−15.5302	−4.30983	−15.5302	No
Inventive ST	G	0.05	12.3	1.5	0.6		0.07	0.03	0.08	13.2	−13.5183	−5.81167	−13.5183	No
Inventive ST	H	0.02	11.5	2.3	0.3		0.32	0.03	0.05	11.95	−15.1902	−4.38979	−15.1902	No
Inventive ST	I	0.05	12.7	3.8	4.7		0.6	0.02	0.07	19.75	−7.45521	−7.44479	−7.45521	No
Inventive ST	J	0.04	9.2	3	0.65		1.15	0.03	0.07	10.175	−16.0192	0.069219	−16.0192	No
Inventive ST	K	0.07	12.1	2	0.1		0.7	0.03	0.1	12.25	−13.1552	−3.14479	−13.1552	No
Inventive ST	L	0.07	12.5	2.5	0.3		1.25	0.02	0.09	12.95	−11.8669	−3.58313	−11.8669	No
Inventive ST	M	0.02	9.8	1.8	0.7		0.95	0.05	0.07	10.85	−16.2519	−2.29813	−16.2519	No
Inventive ST	N	0.04	11	1.48	0.25		0.76	0.02	0.06	11.375	−16.2392	−3.84078	−16.2392	No
Inventive ST	O	0.05	11.5	1.5	0.7		1.35	0.04	0.09	12.55	−13.3002	−4.04979	−13.3002	No
Inventive ST	P	0.03	10.1	3	0		0.8	0.01	0.04	10.1	−17.3675	−1.0325	−17.3675	No
Inventive ST	Q	0.02	11.5	2.3	0.05		0.32	0.03	0.05	11.575	−15.7051	−3.87495	−15.7051	No
Inventive ST	R	0.15	11.9	1.5	0.6		1:35	0.06	0.21	12.8	−8.795	−0.155	−8.795	No
Inventive ST	S	0.04	7.5	1.8	2		0.95	0.05	0.09	10.5	−16.0958	−1.05417	−16.0958	No

Where $\Delta 1 = Ni - (1/12)(Cr + 1.5Mo - 20)^2 + (1/2)Mn + 35(C+N) - 14$

$\Delta 2 = Ni + (1/12)(Cr + 1.5Mo - 20)^2 + (1/2)Mn + 35(C+N) - 14$

Inventive ST: Inventive Martensitic Stainless Steel of the Present Application